# Attributes on Smart Cards

## Efficient Selective Disclosure with Idemix
## &
## IRMA: I Reveal My Attributes

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# Attributes on Smart Cards

## Privacy issues

- Smart cards are "Big Brother's little helper" (Stefan Brands)
- With OV-chipcard / Oyster / Charlie / . . . , you tell who you are when you get on a bus, metro, train, . . .
- Identity-based solutions violate their users' privacy (and increase identity-fraud risk)

## Attribute-based credentials

- Attribute-based authorisation: only provide the information which the system needs
- Example of attribute-based credentials (electronic wietpas):
  - card only says "I'm a Dutch *citizen*, and my *age* is above 18"

# Outline

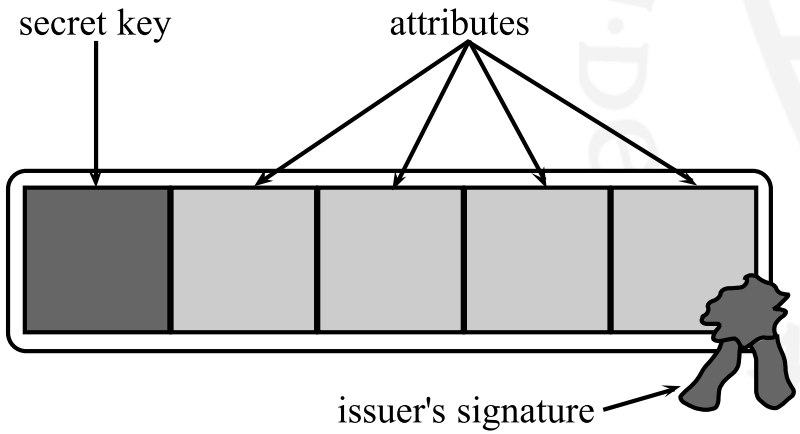
# Credential-based System

**The ideas**

- Attributes
- Selective disclosure / Data minimisation
- Zero-knowledge / Randomisation

**Idemix credential**

- Attributes
- Master secret
- Issuer's signature



# Uses of a Credential

1. **Issuance**
   - *Blind issuing* of a credential
   - Issuer unlinkability
2. **Presentation**
   - *Selective disclosure* of the credential's attributes
   - Randomisation of the Issuer's signature
3. **Verification**
   - *Zero-knowledge proof* using the Issuer's public key
   - Multi-show unlinkability

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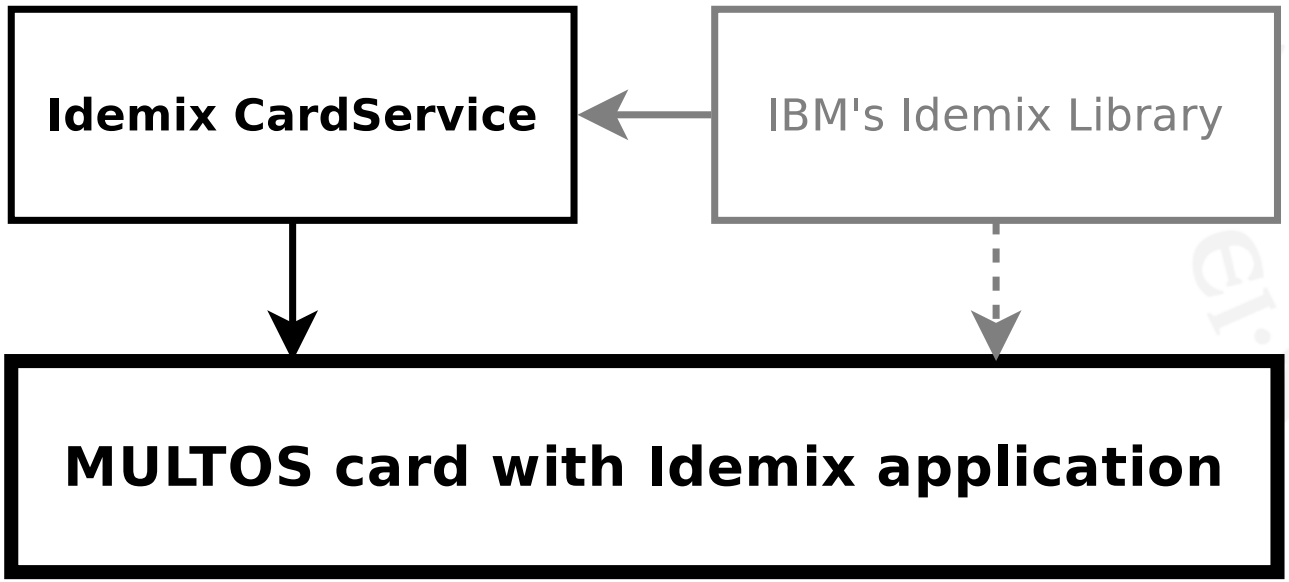
# Design of the System

- CardService translates Idemix commands and data types into APDU commands for smart card communication
- MULTOS implementation, limited by smart card characteristics, is 95% compatible with Idemix Library



# Outline

# Related Work on Smart Cards

## Related work

- Bichsel et al. (IBM Research, 2009), ± 7.5 sec
  Camenisch & Lysyanskaya anonymous credential system
- Sterckx et al. (KU Leuven, 2009), ± 3 sec
  Direct anonymous attestation

## Our previous results

- Batina et al. (RU Nijmegen, 2010), ± 1.5 sec
  Self-blindable certificates of Verheul
- Hoepman et al. (RU Nijmegen, 2010), ± 0.6 sec
  Optimised self-blindable certificates
- Mostowski and Vullers (RU, 2011), ± 0.5 - 0.9 sec
  U-Prove selective disclosure (2-5 attributes)

# Issuance Performance

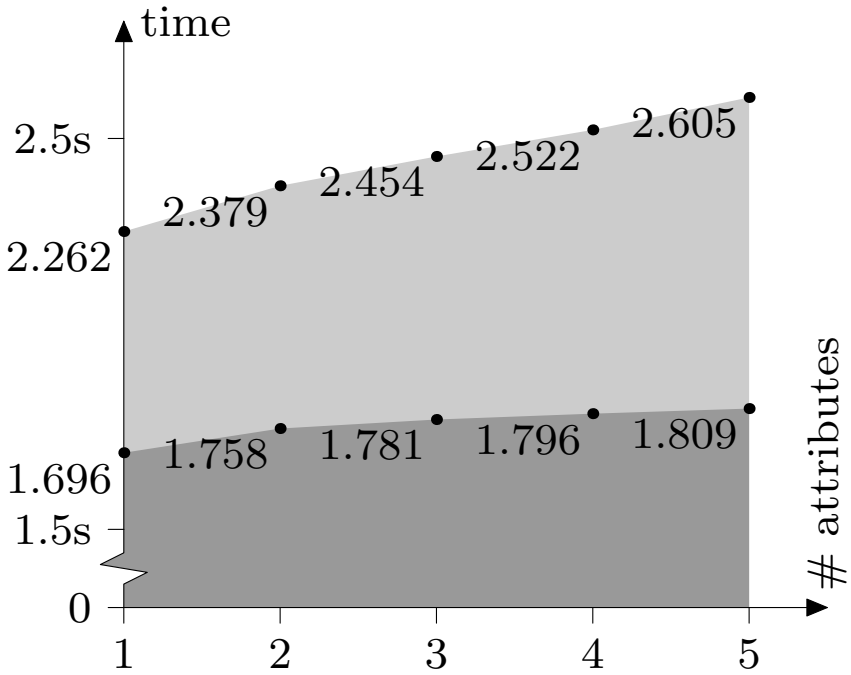
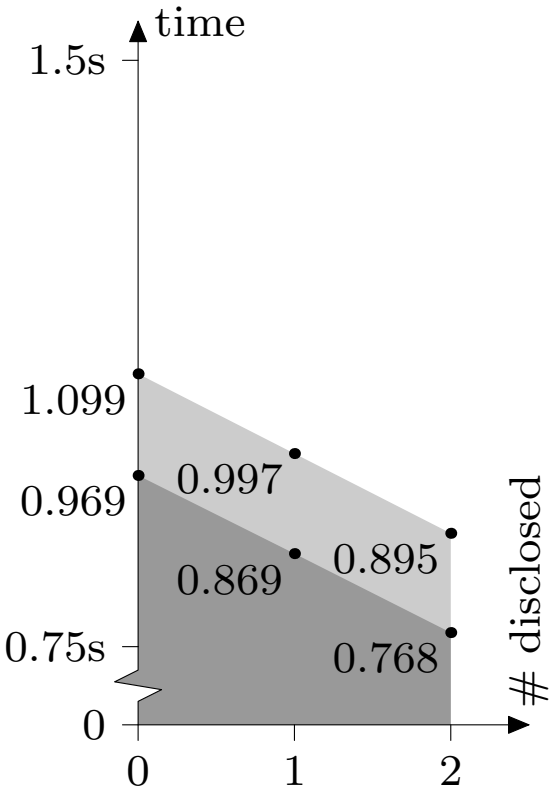
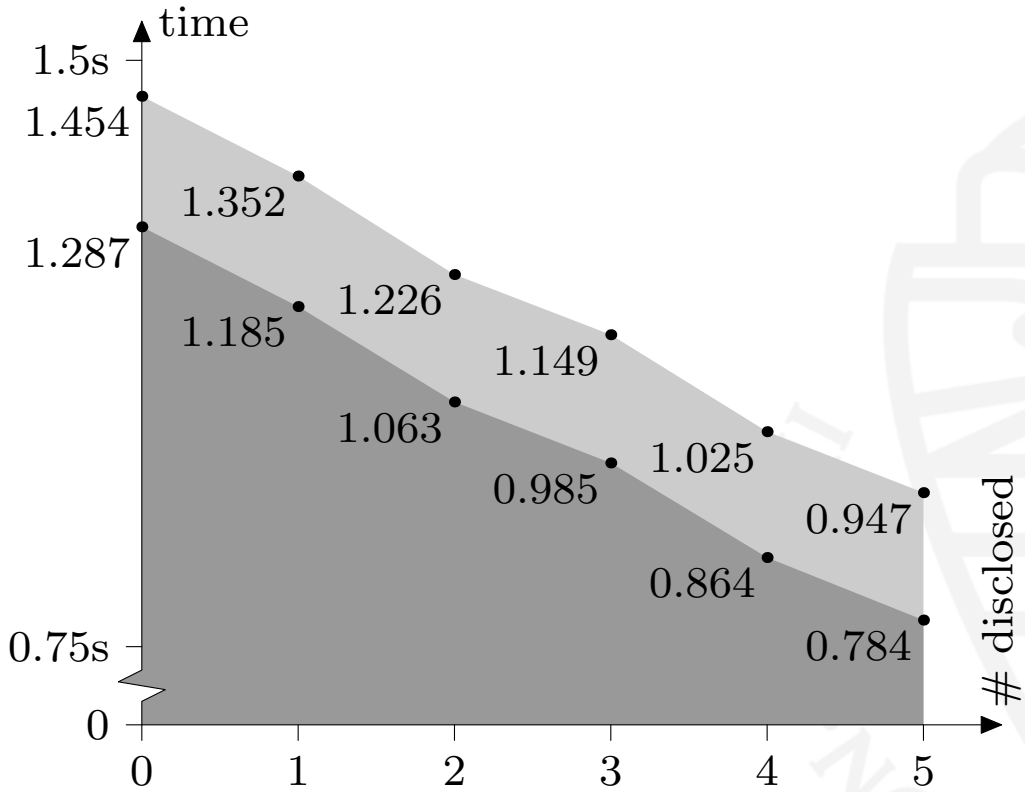



Figure : Credential issuance times (■: computation, ■: overhead).

# Presentation Performance




(a) 2 stored attributes




(b) 5 stored attributes

Figure : Attribute verification times ( : computation, : overhead).

# Conclusion

- *Efficient MULTOS implementation* of the Idemix technology
- *Multi-show unlinkability* of the credentials on the smart card

- Attribute-base credentials on smart cards are possible
- Major improvement over IBM's DAA implementation

**Next steps:**

- Studying other technologies
- Practicing with other platforms

- Making anonymous credentials *usable*


IRMA
I reveal my
attributes

# IRMA – I Reveal My Attributes

1. **Pilot project**
   - Kerckhoffs students will receive an IRMA card
   - Online credential issuance, free printing, discount on coffee

2. **Proof-of-Concept**
   - Project for the government
   - MijnOverheid integration, POS-terminal integration

## Project partners:

Radboud University Nijmegen

novay

TNO

SURFNET

SIDN

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# Questions